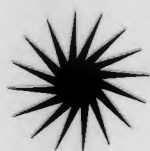




TOTAL VISION DISPLAY SYSTEM



REDIFFUSION
Simulation

Displaying the world in a new perspective

Flight crews training on current generation simulators have come to expect a training environment which realistically represents the operating conditions of the real world.

And, in almost every respect, their expectations are fulfilled.

Very rapid technological developments, together with much improved aircraft data, have enabled simulator manufacturers to produce machines which 'fly' exactly like the aircraft they represent. Recognition of this fact is evident in the willingness of regulatory bodies throughout the world to allow an increased, and in some cases a total, transfer of training from aircraft to simulator.

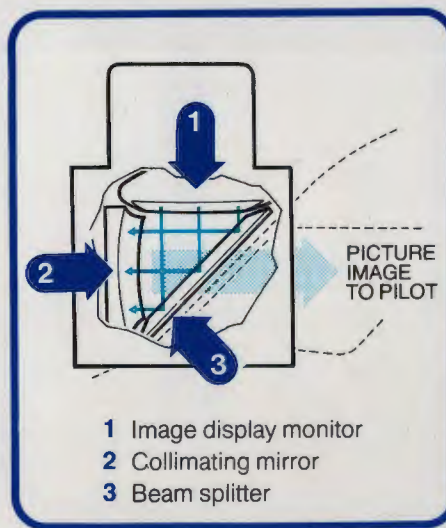
Yet there remains one very obvious area where today's simulators deviate substantially from the real world — in the display of the out-of-the-window visual scenes.

Now, Rediffusion's WIDE total vision display system changes all that.

Conventional technology

The first simulator visual systems, which appeared during the 1960's, relied on closed circuit television to generate and display scenes to the occupants of the flight deck. A camera 'flying' over a terrain model to the instructions of the simulator's central computer produced television pictures that were displayed on a screen in front of the flight deck windows. Although innovative, the technique lacked the flexibility of modelling, field of view and reliability of operation to be a prolonged success in the face of the new and advancing technologies.

The acceptance and development of Computer Generated Image technology in the early 1970's is well documented within the flight training industry. Rediffusion's current generation Novoview SP and CT5 systems provide real world scenes under a wide variety of environmental and tactical conditions. Image generation technology has developed rapidly to allow full daylight simulation and a range of effects, which are currently being demanded by international regulatory authorities, to improve operational realism. Typically such effects include contaminated



Conventionally CGI scenes are displayed using individual monitor based modules around the flight deck windows.

runways, specific weather conditions and conflicting traffic. Multiple models can be stored on a single floppy disc and linked together to form coherent Line Oriented Flight Training scenarios.

In contrast, display techniques have remained unchanged for almost a decade.

Conventionally CGI scenes are displayed through individual monitor based modules mounted around the flight deck windows. Each module is optically arranged for the viewpoint of a single observer, so that cross cockpit views are not possible and the participation of other crew members and the instructor in training exercises is restricted. And, whilst the system meets all current flight training regulations it remains fundamentally removed from the real world.

Closer to reality

Clearly however, a system which fully exploits the new realism of today's image generation capability is essential. This is particularly so for the newer aircraft types where the flight deck design provides greater fields of view, and for three man crew types where the engineer is an integral part of flight operations.

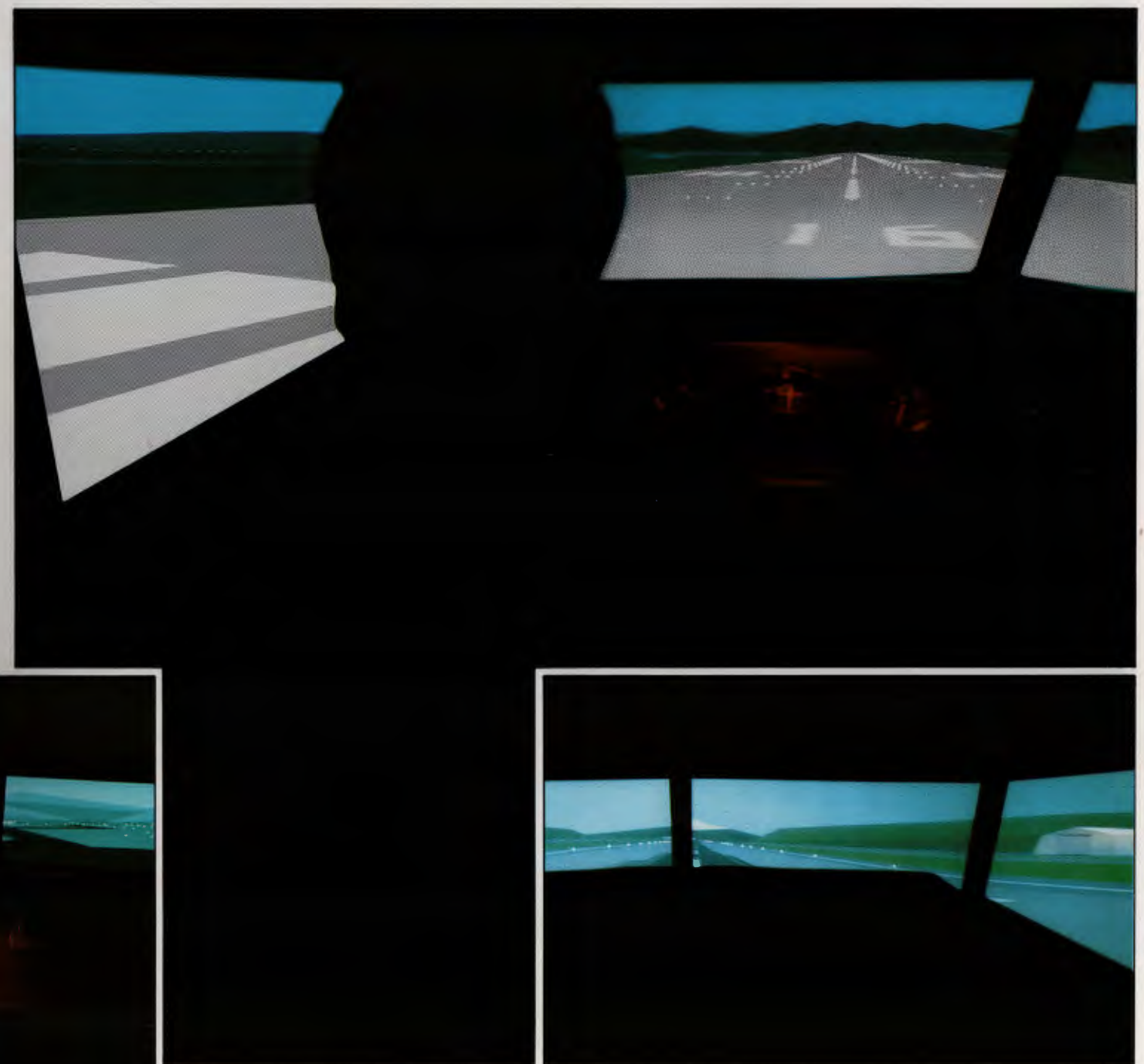
Rediffusion's WIDE (Wide-angle Infinity Display Equipment) is such a system. It is the result of extensive research and development and its significance extends well beyond

simply moving display technology forward a generation. In presenting CGI scenes to the entire flight deck, without optical limitation, WIDE brings the whole business of flight simulation substantially closer to the real world.

Fundamental to the system's success has been the development of an advanced calligraphic projector capable of translating the complex signals from all Rediffusion image generating computers into high resolution projected pictures. WIDE is now a fully developed product and is based on hardware which has been tested and designed to meet all the operating and maintenance criteria of the most demanding simulator installation.

As a display system it is absolutely unique. No display concept currently under development matches its potential and yet, as these pictures demonstrate, it is already a definitive product.

In the evolution of today's advanced technology flight simulator WIDE is probably the most exciting development in a decade.



These Novoview SP2 scenes demonstrate the realism which WIDE brings to the presentation of CGI scenes in particular, and to the simulated training environment in general. They were photographed on a development system and are authentic. The windscreen and glare-shield profile is to full scale Boeing 737 dimensions.

The most exciting simulator development in a decade

Continuous field of view

WIDE exceeds current regulatory criteria by providing each flight deck occupant with an uninterrupted field-of-view which extends over 150° horizontally by 40° vertically. It uses three Rediffusion calligraphic projectors mounted above the simulator cab projecting an image onto a specially designed back-projection screen. The image so formed is viewed by the occupants of the flight deck from a large diameter collimating mirror extending around the entire flight deck structure.

Great emphasis has been placed on the optical development of the system's component parts to maximise picture brightness and resolution in the scene presented to the flight deck. Specially cut lenticulations on the

surface of the back-projection screen allow the axial intensity of each projector beam to be substantially maintained, even though the image is being viewed off axis.

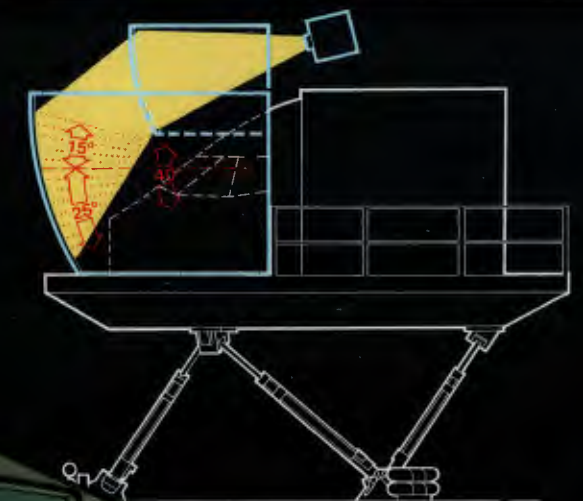
Variations in the geometry of the system are possible to meet specific training demands. The 40° vertical field of view, nominally distributed as 25° below and 15° above the horizontal axis, can be redistributed to give greater upward vision for applications such as in-flight refuelling and, greater downward vision for ground related training exercises.

Simulator compatibility

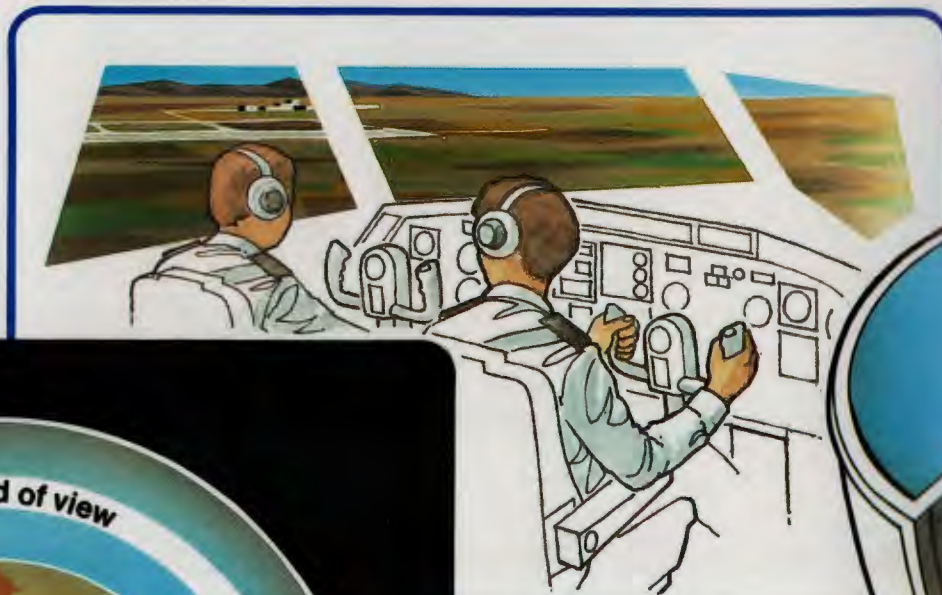
The WIDE display system has been designed for use with all current Rediffusion Computer Generated Image visual systems – Novoview SP series and CT5. It is therefore relevant to both civil and military flight simulator applications and is obviously important in overcoming many of the visual display problems currently associated with helicopter simulation. Priority has been given to meeting the physical requirements of simulator

compatibility. Both weight and inertia have been carefully examined to ensure the system is potentially capable of attachment to all current generation motion platforms.

WIDE also may be logically retrofitted to simulators currently in the field, although such projects would require a detailed survey of the overall installation. In general terms however, the system requires no special environmental conditions to operate efficiently, although it inevitably extends slightly the envelope of the simulator.



Vertical field of view is 40° distributed nominally as 15° above and 25° below the horizontal axis. Special lenticulations in the back projection screen maintain the axial intensity of each projector beam.

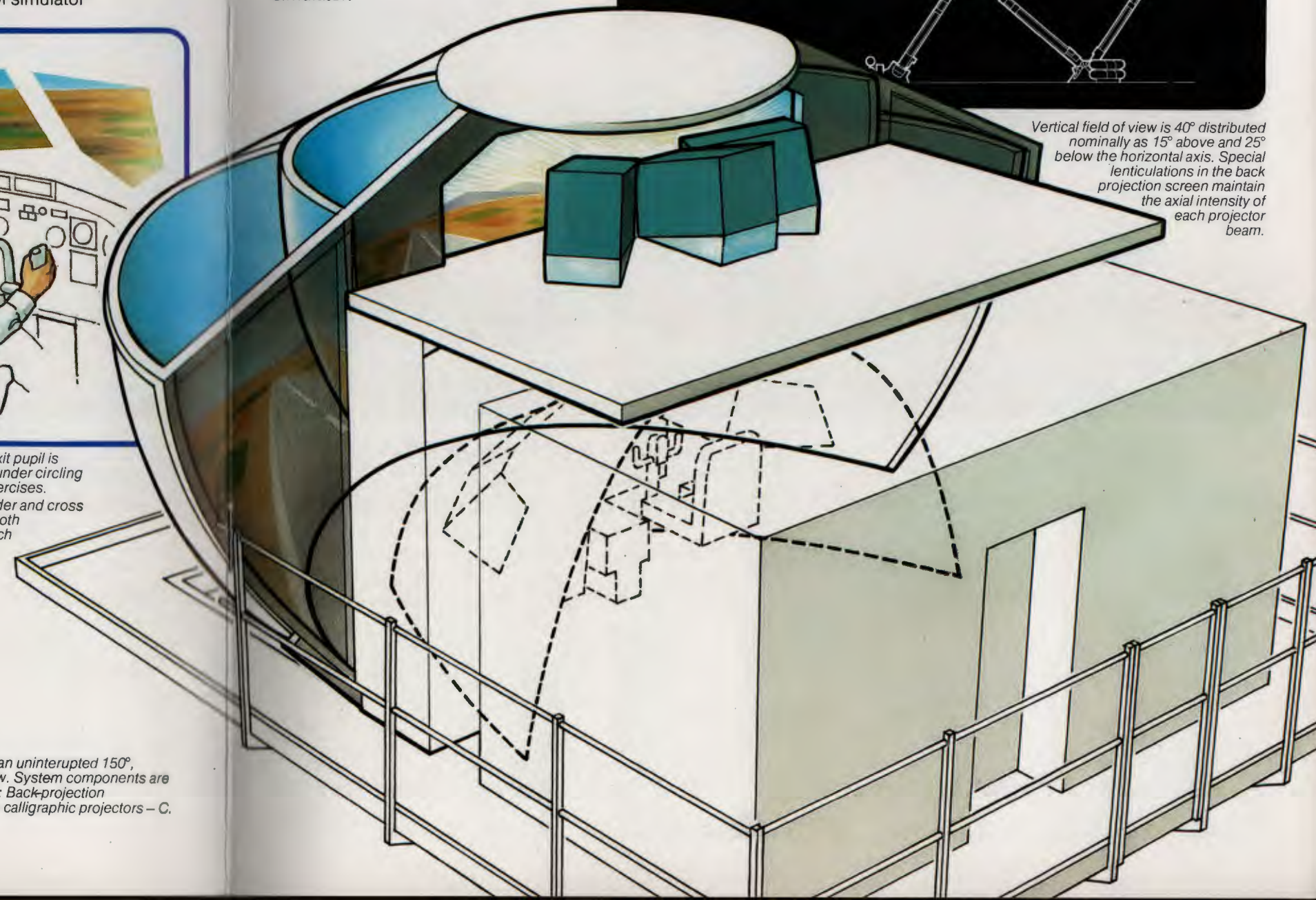


WIDE's large exit pupil is particularly relevant under circling approach training exercises.

Over the shoulder and cross cockpit views allow both pilot and co-pilot much greater visual perception.



WIDE provides an uninterrupted 150° horizontal field of view. System components are collimating mirror – A; Back-projection screen – B; and triple calligraphic projectors – C.



A solution in line with today's flight training demands

Like all the best design concepts WIDE's major advantage is its simplicity. In hardware terms component parts are minimised and all have been tested under prolonged operational conditions.



An advanced calligraphic projector designed and built by Rediffusion is at the heart of the WIDE System.

Advanced projection technology

In bringing the WIDE system to full product status the greatest problem Rediffusion engineers have had to overcome is in the design of the calligraphic projector.

The monitors used in conventional display systems are themselves specially designed to cope with the highly complex signals produced by image generating computers. The new projector has been designed and built by Rediffusion Simulation from the outset specifically to meet the flight simulator application. It uses red, green and blue projector CRT's to produce full colour, high resolution CGI pictures under day, dusk and night conditions. The three projectors are electronically matched to eliminate gaps in the overall display and, their structural integrity ensures reliable operation within the motion system environment.

A significant feature of the system is a remote control facility allowing full set-up procedures to take place from any position on the flight deck.



A complete operational system

As the world's leading flight simulator manufacturer Rediffusion has more than 30 year's experience in the design, production and operational support of both civil and military equipment. That experience has been built into the operational and maintenance facilities of the WIDE system. Both the mirror and the back projection screen require minimal maintenance whilst projector tubes are designed for long life and rapid in-situ replacement.

A very significant feature of the system is a portable projector control unit. From the simulator flight deck the unit allows full set up procedures to take place from any viewpoint. In operational use this allows maintenance engineers the facility to optimise colour balance and projector convergence from actual flight crew positions.

WIDE is compatible with all Novoview and CT5 image generating computers.



Mirrors and optical components require minimal operational maintenance.

In summary WIDE is a proven, very practical solution to the problems of bringing Computer Generated Image display technology in line with the real world.

System Parameters

- 150° uninterrupted x 40° vertical, instantaneous field of view from 3 CGI channels
- Large exit pupil, continuous, collimated full colour display.
- 6 foot-Lambert highlight brightness.
- 3 arc minute resolution.
- Inherent immunity to reflections permits use of high cockpit ambient light levels under day conditions and removes constraints associated with distracting reflections.
- Signal input format allows compatibility with calligraphic, raster-scan or hybrid image generators.
- Simplicity of design ensures high reliability, minimal maintenance and low cost of ownership.

The WIDE system has been designed to be fully compatible with all current motion platforms.





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